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AGRICULTURAL CHEMISTRY.—*The active acidity of soils.*[1]

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In a solution of an acid substance, part of the acid exists in molecular form and is not capable of producing directly the effects attributable to acids; but another part is ionized, that is, separated into electrically charged portions, and one of these portions, namely the positively charged hydrogen, known technically as hydrogen-ion, is the immediate cause of most acidity phenomena. Some writers have classed the portion of the acid thus ionized as "actual," "real," or "true" acid. Such terms are, however, inappropriate, for chemical compounds are just as "real" as are atoms or ions; and descriptive adjectives like "active," "effective," or "potent" are much to be preferred. The first of these seems least likely to be misunderstood, and is therefore used here. "Active acidity," then, signifies acidity due to positively charged hydrogen ions. Correspondingly, "active alkalinity" is that due to negatively charged hydroxyl or (OH) groups. Titration measures not only the active but also the non-ionized acid or alkali; in other words, titrable acidity or alkalinity correspond to the *total* acid or alkali. The *active* acid and alkali, which affect directly the growth of plants and other phenomena of importance in agriculture, however, are, in the light of recent developments, of the greater significance.

That agricultural soils can become sour or acid and as a result act unfavorably on the growth of certain crops has long been recognized, and many methods have been proposed to ascertain the degree of acidity attained in a given case, the more important of which may be summarized as follows:

[1] This paper was presented in preliminary form at a symposium on *Relation of soil acidity to classification*, held by the American Association of Soil Survey Workers, in Chicago, September, 1923. It was distributed in mimeographed form in the proceedings of that meeting. The present revision presents a better statement of the writer's views.

1. The growth of weeds is observed.
2. Lime-requirement is determined,
   A. By adding a solution of a salt, and determining the resulting acidity by titration or other means.
   B. By direct titration with lime water.
3. Pure water is added to the soil, and the active acidity is measured:
   A. Electrometrically.
   B. Color-comparatively.

1. *The growth of weeds is observed.*—The farmer is accustomed to accept the appearance in a field of sorrel (*Rumex acetosella*), of certain grasses, such as beard-grass (*Andropogon spp.*) or of almost any kind of moss as a sign that the soil is becoming "sour." The writer has made a number of tests of the active acidity present under such circumstances, and has found that these indications are not dependable. Sorrel, beard-grass, and many species of moss, while they admittedly do grow frequently in soils which have really become acid, also thrive luxuriantly in soils which from the chemist's point of view are not acid at all, but are distinctly, or even rather strongly, alkaline. It is possible that these plants really indicate a diminution in the amount of available nitrogen in the soil, for they may have some means of obtaining nitrogen not possessed by ordinary crop plants. Lime might benefit such soils, then, not because of its neutralization of any acidity, but because in some other way it favors the growth of nitrifying organisms; but when the "sour" soil already contains sufficient calcium to satisfy these organisms, the liming will not produce any effect at all.

It is concluded, accordingly, that observation of weeds is an unsafe basis for diagnosing the presence of active acidity, and that the farmer's term "sour" means nitrogen-poor, and not acid at all.

2. A. *Lime requirement is determined by adding a salt solution and titrating.*—The significance of the "lime-requirement" methods in which salts are added to the soil has already been discussed by the writer[2] but may well be stated here in a new form. The salt is believed to react with the soil colloids in the following manner:

$$KNO_3 + HX \rightleftarrows KX + HNO_3.$$

Here X is used to represent the colloidal matter in the soil, which possesses some acid properties, although these are modified by its slight solubility. On the other hand the nitric acid developed in the reaction is completely soluble, so that the salt treatment method results in a marked increase of the soluble acid. The use of salts other than

[2] Soil acidity and a field method for its measurement. Ecology 1 : 160–173. 1920. Smithsonian Rept., 1920: 247-268. 1922.

KNO_3, such as $NaC_2H_3O_2$ or $CaCl_2$, will produce analogous effects, but the extent to which the reaction goes in one direction or the other, and correspondingly the amount of soluble acid developed, will vary with the salt selected. Titration will accordingly yield a value representing not the original acidity of the soil solution, but acid resulting from a reaction going to an equilibrium varying with a salt chosen at random. For any one salt, it is evident that the amount of acid developed will be more or less proportional to the colloid content of the soil under study. Since most of the lime added to soils in practice appears to be taken up by the colloids, these methods give, in some soils at least, rough indications of the lime-requirement; but this bears no apparent relation to the active acidity.

An explanation is thus afforded for the well known fact that the salt-treatment methods yield a value varying with the salt used; and it is concluded that while the results correspond roughly to colloid content, they are without significance as far as active acidity of the soil is concerned.

2. B. *Lime-requirement is determined by direct titration with lime-water.*—If an indicator which shows its color change at the neutral point is used, titration of the soil itself with lime water does yield a definite value for lime-requirement. This is not to be regarded as proportional to the active acidity, however. For, besides neutralizing active acid originally present in the soil solution, some of the lime is used in neutralizing inactive and practically insoluble acids, and some in decomposing iron and aluminum salts, while a further quantity is adsorbed by the soil colloids. There is reason to believe that a far greater amount is taken up in the last three ways than in the first. Actual comparison of the values for active acidity and lime-requirement obtained by several workers on the same soil samples has shown[3] that, with the units used (lime-requirement in parts per thousand, and active acidity in units of 10^{-7} grams per liter), the lime-requirement values ranged from 0.002 to 2.5 times the active acidity. Even though the majority of ratios lay between 0.02 and 0.10, the proportionality of the two quantities can not be regarded as particularly close.

It can only be inferred that lime-requirement determined by direct titration is not a measure of the active acidity of the soil.

3. A. *Active acidity is measured electrometrically.*—It has become the practice in recent years to measure active acidity by means of the hydrogen electrode, and to assume that this gives fundamentally dependable values. The fact that this method requires considerable

[3] Relations between the active acidity and lime-requirement of soils. Journ. Wash. Acad. Sci. 13: 97–162. 1923.

experience to operate, is usually overlooked, however. Not much experience is necessary when everything runs smoothly, but considerable may be required when all sorts of unexpected troubles arise and have to be avoided. For instance, the electrode is easily affected by impurities in the hydrogen or by mercury migrating over from the calomel comparison cell, and without being detected for a long time, may give results uniformly in error. Moreover the readings obtained may not be representative of the soil's original acidity, because the hydrogen may sweep out some carbon dioxide, or may reduce nitrates, and in either case yield an arbitrarily modified potential value.

It is concluded, then, that this method, while admittedly of great value, is not certain to yield the correct active soil acidity in every case.

3. B. *Active acidity is measured color-comparatively.*—The simpler color-comparative method of determining active acidity (or alkalinity) also possesses certain inherent disadvantages. The turbidity or color of the soil extract may mask the color changes, although the use of a cancelling-out device diminishes the difficulty from this source. The proteins and salts present in the soil solution may shift the equilibria of the dyes used to such an extent as to give erroneous readings. The addition of too much dye to the soil extract is one manipulative error which may occur, especially if the convenient spot plate is used. The majority of workers who have used the color-comparative and electrometric methods on the same soils, taking care to avoid errors of manipulation in both, have found that the two methods check one another well within the limits of variation of the material.

There is now on the market an apparatus for attaining a considerable degree of precision by the color-comparative method, even under field conditions. The soil extract is placed in a tiny celluloid cell, and mixed with a drop of the indicator found by preliminary tests to be visibly affected by it. The color produced is compared with that shown by the same indicator in a Barnett double wedge,[4] turbidity being cancelled out by the use of a cell containing untreated extract, placed behind the double wedge.

Utilization of data on active soil acidity and alkalinity.—Measurements of active acidity or alkalinity made as above described may be utilized to construct special soil-reaction maps. O. Arrhenius[5] has published such a map of an area in Sweden, showing by color patterns the patches occupied by soils of different acidity ranges. The writer[6]

[4] Colorimetric determination of hydrogen-ion concentration by means of a double wedge comparator. Proc. Soc. Exptl. Biol. Med. 18: 127–131. 1921.

[5] Bodenreaktion und Pflanzenleben. Special publication 20 pp. Gustav Fock, Leipzig, 1922.

[6] A soil acidity map of a Long Island wild garden. Ecology. 4: 395–501. 1923.

constructed one in which "acidity-contour" lines were used for the same purpose. However, a statement in the text of a soil survey report, concerning the usual reaction-range of each soil type covered, would be sufficient for most purposes.

Such information will make possible the selection of land most nearly suited to the active acidity or alkalinity needs of individual crops. As pointed out by Arrhenius in the paper cited and elsewhere,[7] every crop plant probably has its own optimum active acidity or alkalinity and can be grown most successfully in soils approaching this value. Although this optima for individual crops are not as yet very definitely known, they are sure to be determined sooner or later, and knowledge as to the reaction of given areas will then be of great importance.

Moreover, active acidity and alkalinity, besides favoring the growth of crop plants when present in certain amounts, produce other effects. It is well known that they are directly toxic when they reach sufficiently high concentrations and also that they influence the solubility of iron and aluminum, so that the toxicity of certain soils may be indirectly related to the reaction. They affect both beneficial and injurious soil organisms in a variety of ways, active acidity favoring, for instance, the development of nitrifying bacteria when its concentration approximates to 2 units (of 10^{-7} grams) per liter, and preventing that of the potato scab fungus when it exceeds 100 such units per liter. The importance of having information as to the active acidity or alkalinity of every agricultural soil is evident.

Summary.—The significance of active acidity as opposed to total acidity is pointed out. The methods which have been proposed for ascertaining the degree of acidity attained by a given soil are reviewed, and some of them are shown not to yield active acidity values at all. Both electrometric and color-comparative methods of determining active acidity have inherent defects, but when care is taken to avoid errors of manipulation, the two methods give accordant results. The second of these is the simpler, and a convenient apparatus for applying it in the field is now available.

Active acidity and alkalinity are important in connection with the growth of plants, both directly and indirectly. They may be directly toxic in high concentrations and indirectly toxic through affecting the solubility of iron and aluminum. They also exert a marked influence on the activities of various soil organisms, both beneficial and injurious. In the writer's opinion, no soil survey can be regarded as complete without including determinations of the reaction in terms of active acidity or alkalinity.

[7] Some contributions to the knowledge of the relation between soil reaction and the development of certain crop plants: An orienting investigation. (In Swedish) Kungl. Landtbr. Akad. Handl. Tidskr. 62: 417–428. 1923.

BOTANY.—*Notes on* Tacsonia.[1] ELLSWORTH P. KILLIP, National Museum.

The genus *Tacsonia* was established[2] by Jussieu in 1789 to accomodate certain species of *Passiflora* distinguished by a long flower tube and a reduced faucial corona. Up to 1873 it was generally recognized as valid, though there was much diversity of opinion as to which species should be placed in it. Masters, the principal authority on the Passifloraceae, retained it in his elaborate monograph,[3] although both in an earlier paper,[4] in which he discussed the genera of Passifloraceae in greater detail, and in the course of subsequent publication of new species under this generic name he evidenced much doubt as to the propriety of keeping it distinct from *Passiflora*. Triana and Planchon, in their monograph[5] of the Colombian Passifloraceae, made *Tacsonia* a subgenus of *Passiflora*, and Harms, who in recent years has been the principal student of the family, has so treated it.

Study of a great amount of Andean material now at hand, as well as of living plants in Colombia, has led me to agree with Triana and Planchon and Harms that the characters upon which *Tacsonia* has been recognized are neither sufficiently constant nor important enough to justify its retention as a genus distinct from *Passiflora*. The grounds upon which this opinion is based are stated in some detail in a manuscript soon to be published, dealing with the Andean Passifloraceae, and need not be repeated here. However, in order that the names of several species not yet removed from *Tacsonia* to *Passiflora* may be available, these transfers are now made.

Passiflora coactilis (Mast.) Killip, comb. nov.

Tacsonia coactilis Mast. Bot. Jahrb. Engler **8**: 216. 1887.

Passiflora ecuadorica Killip, nom. nov.

Tacsonia hederacea Mast. Journ. Linn. Soc. **20**: 29. 1883. Not *Passiflora hederacea* Cav. (1790).

Tacsonia cyanea Sodiro, Anal. Univ. Quito **18**: 410. 1903. Not *Passiflora cyanea* Mast. (1872).

Comparison of a specimen of the type collection of *Tacsonia hederacea* Mast., in the New York Botanical Garden, and the type of *Tacsonia cyanea* Sodiro, in the National Herbarium, proves that the two are conspecific. Both species names, unfortunately, would be invalid under *Passiflora*.

[1] Published by permission of the Secretary of the Smithsonian Institution.
[2] Gen. Pl. 398. 1789.
[3] Mast. Fl. Bras. **13**[1]: 535–542. 1872.
[4] Trans. Linn. Soc. **27**: 625. 1871.
[5] Ann. Sci. Nat. V. Bot. **17**: 122–145. 1873.

Passiflora mandoni (Mast.) Killip, comb. nov.

Tacsonia mandoni Mast. in Mart. Fl. Bras. 13[1]: 538. 1872.

Passiflora psilantha (Sodiro) Killip, comb. nov.

Tacsonia psilantha Sodiro, Anal. Univ. Quito 18: 417. 1903.

ENTOMOLOGY.—*Notes on and descriptions of some sawflies from Japan (Hym.).* S. A. ROHWER, Bureau of Entomology.

The species treated in this paper were sent for determination in the summer of 1919, and shortly after their receipt a manuscript describing them was sent for publication in the Entomological Magazine. Unfortunately this magazine has been, at least temporarily, discontinued, and only recently was the manuscript returned. In the interval, certain Japanese students have written briefly concerning one of these species, and I am informed that manuscripts on the other two are in the course of publication. It is my understanding that these manuscripts deal with the habits and do not contain technical descriptions of the species.

Tomostethus (Eutotomostethus) **juncivorus,** sp. nov.

Allied to *luteiventris* (Klug), but the middle fovea is not deep and the claws have an inner tooth.

Female.—Length 6 mm. Robust. Clypeus gently convex with large setigerous puncture, the anterior margin truncate; supraclypeal area somewhat depressed, flat; antennal foveae large, deep; middle fovea represented by two impressed lines which diverge dorsally; ocellar basin large, octagonal, open above and below but the lateral walls well defined; a transversely oval depression in front of anterior ocellus; postocellular line distinctly shorter than the ocellocular; postocellar furrow well defined, angulate anteriorly; postocellar area well defined, convex; head shining with front subopaque; antenna short and stout, the third joint subequal in length with the fourth and fifth; thorax shining, the posterior part of the thorax with a few large punctures; stigma broad, rounded below; interradius strongly curved, joining radius at about the apical fourth of third cubital; nervulus distinctly beyond the middle of cell; nervellus well before middle of discoidellan cell; claws with an erect inner tooth; sheath straight above rounded at tip then sharply oblique then gradually widening to the base. Black; legs except bases of coxae and infuscate apical tarsal joints reddish-yellow; abdomen (including propodeum) rufo-ferrugineous, sheath black; wing hyaline, faintly dusky; venation black.

Male.—Length 5.5 mm. Structure as in female; hypopygidium broadly rounded. Black; apical joints of palpi, legs except bases of coxae and infus-

cate apical joints of tarsi yellowish with the femora reddish yellow; abdomen rufo-ferrugineous, propodeum, four apical tergites and two apical sternites black; wings as in female.

Type-locality.—Kurashiki, Okayama-keen, Japan. Described from two females (one type) and two males (one allotype) sent by Chukichi Harukawa who says the larva "feeds upon cultivated *Juncus* sp." Material labled May 1918.

Type.—Cat. No. 22390 U. S. National Museum.

In Insect World,[1] there is listed a *Tomostethus apicalis* Matsumura, but I can find no other record for such a species and have considered *apicalis* as a manuscript name.

Since the above description was prepared Mr. Harukawa has given me additional specimens, some of which belong to the second generation of the species. According to Mr. Harukawa, the second generation of females differs in color from the first. There is no apparent difference in structure in the male or female, but the females of the second generation differ from the first (or spring) generation in the following color characters: Pronotum, tegulae, mesonotum except a triangular spot on the prescutum, metanotum, and a spot on the posterior part of the mesepisternum rufo-ferrugineous.

Eriocampoides matsumotonis Harukawa

Eriocampoides matsumotonis Harukawa, Journ. Plant Protection, Tokyo, vol. 6, no. 1, Jan. 5, 1919, pp. 51–59, 1 plate; Harukawa, Ber. Ohara Instituts Forsch., Japan, Bd. 2, H. 1, 1921, p. 21.

This species was originally described as new from material received in 1919, but subsequently Mr. Harukawa has written two papers on it which contain sufficient descriptive matter and illustrations to fix the name and make it necessary to accredit the species to him. The following description of the material before me is published to give a more elaborate description of the adult and some comments on its relationship with exotic forms.

Of the Palaearctic species this species seems more closely allied to *lamacina* (Retzius) but it is smaller, the position of the interradius is different and there are also differences in the head.

Female.—Length, 4.5 mm. Clypeus smooth, the anterior margin rather deeply, broadly, subangulately emarginate, the lateral angles sharp; antennal foveae large, extending to base of clypeus; supraclypeal area convex, rectangular in outline; middle fovea elongate, open above, deep, well-defined; frontal foveae punctiform but in a gradually depressed area, situated a little below a line drawn tangent to top of middle fovea; ocellar basin indicated as a raised wedge-shaped area; postocellar furrow wanting; postocellar area convex; postocellar line longer than ocellocular line; vertical furrows distinct, deep; antenna about as long as head and thorax, slightly thicker in middle; clothed with stiff black hair, third joint but little shorter than the fourth and fifth, which are subequal in length; stigma large, straight below to an obliquely truncate apex; interradius straight, inclined at same angle as third intercubi-

[1] 23, no. 5: 886. 1919.

tus, joining radius distinctly before the middle of third cubital cell; third cubital subequal with the first and second; first, second and fourth abscissae of cubitus subequal; nervulus its length from basal; intercubitella well beyond recurrentella; anallen cell sessile at nervellus; sheath straight above to near apex when it narrows to a rather pointed apex, rounded below. Black, shining, with short black hair; four anterior tibiae and tarsi brownish-yellow; hind tibiae and tarsi brownish with a faint indication of a yellowish color; wings fulvigineous to apex of stigma then hyaline; venation black.

Male.—Length, 3.5 mm. Hypopygidium broadly rounded apically; interradius at about middle of cell; structure and color as in female. In the paratype male, the interradius joins the radius before the middle of the third cubital.

Redescribed from two females and two males sent by Chukichi Harukawa who says the larvae feed "upon the leaves of pear, peach and some other *Prunus* spp." Material labeled July, 1918.

In general appearance this species looks more like *E. amygdalina* Rohwer than it does like *E. limacina*, but it is to be distinguished from *amygdalina* by the darker legs and wings and different shaped middle fovea.

Hoplocampa (Hoplocampa) **pyricola,** new species.

This species is very closely allied to the European *H. minuta* and will fall there in Enslin's key to the species. It differs from European specimens determined by F. W. Konow as follows: the transverse depression above the median tubercle is straight (not curved); the emargination of the clypeus is arcuate (not slightly angulate); the sheath is sharply pointed at the apex (not narrowly rounded); the contraction of the lanceolate cell is equal (not longer than) with the nervulus; the stigma is more distinctly truncate; the cubitellan cell is longer (not shorter) than the discoidellan cell. Practically all European literature records *minuta* as living within the fruits of *Prunus*, while this new species is said to live within the fruits of *Pyrus*.

Female.—Length, 3.5 mm. Clypeus convex, the anterior margin broadly, shallowly, arcuately emarginate; supraclypeal area polished, strongly convex, rectangular in outline; depression across the top straight; median fovea represented by broad, shallow, poorly defined depression; antennal furrow complete; postocellar furrow complete, straight; postocellar area slightly convex; antenna slender, third joint slightly shorter than fourth. Black; apices of antennae piceous; tibiae except infuscated apices, and tarsi sordid whitish; wings subhyaline; venation pale brown.

Male.—Length, 3.25 mm. The male agrees very closely with the female except the median fovea is slightly better defined and the flagellum is entirely ferrugineous; the apical portions of the femora and the anterior pair beneath are rufo-piceous.

Type-locality.—Yokohama, Japan. Described from six (one type) females and four (one allotype) males reared April 27, 1917, from pear fruits and forwarded by S. I. Kauwana.

Type.—Cat. No. 22391, U. S. N. M.

PROCEEDINGS OF THE ACADEMY AND AFFILIATED SOCIETIES

PHILOSOPHICAL SOCIETY OF WASHINGTON

892D MEETING

The 892d meeting, being the 53d annual meeting, was held in the Cosmos Club Auditorium on Saturday, December 1, 1923. It was called to order by PRESIDENT WHITE with 43 persons in attendance.

The joint report of the Secretaries for the year 1923, read by J. P. AULT, Recording Secretary, may be summarized as follows: Nineteen meetings were held during the year. Thirty papers and six informal communications were presented, 156 members taking part in the discussion.

The General Committee held 14 meetings during the year. The sum of $1200 was appropriated to cover the expenses of the Society during the year.

The following officers were elected for the year 1924:

President, D. L. HAZARD.

Vice-Presidents, W. BOWIE, H. H. KIMBALL.

Treasurer, P. R. HEYL.

Corresponding Secretary, L. H. ADAMS.

Member at Large, General Committee, S. J. MAUCHLY, F. E. WRIGHT.

While the tellers were counting the ballots, President White gave opportunity for an informal communication. Mr. Hawkesworth presented an informal communication *Change of density of the earth's crust with increased distance below the earth's surface.* The communication was discussed by Messrs. HEYL, LAMBERT, and TUCKERMAN.

Following the business session, H. L. CURTIS addressed the Society on a *Camera for Photographing Projectiles in Flight.* The paper was illustrated with lantern slides, and one of the cameras used in the experiments was exhibited. The following members took part in the discussion: Messrs. PAWLING, MAUCHLY, HAWKESWORTH, CRITTENDEN, LAMBERT, HEYL, HUMPHREYS, HAZARD, and WADLEIGH.

It is possible with an ordinary camera to obtain a picture of a projectile in flight provided the time of exposure is extremely short and provided also that the operator is sufficiently fortunate to make the exposure at the right instant. With the moving picture camera one will usually obtain a single picture of a projectile which will be blurred and indistinct. For photographing small projectiles, the method of illumination by means of a spark has given very satisfactory pictures. One or two methods have been devised for taking pictures by daylight. The camera which is here described is of the latter type, and employs some principles which have not heretofore been used. In this, the film is caused to move with the same velocity as the image of the projectile. This produces a picture which is free from blur and distortion. By mounting a number of lenses at right angles to the motion of the film, and by properly arranging the openings in the focal plane shutter, it is possible to obtain as many pictures of the projectile as there are lenses. Also, by determining the speed of the film by means of flashes of light from a tuning fork, and by knowing the distance from the projectile to the camera, it is possible to compute the velocity of the projectile.

Eleven lantern slides were shown which were made from pictures taken with this camera. All of these showed that projectile in flight in different positions, some near the muzzle of the gun, others in free flight, and still others as the projectile was entering an armor plate. (*Author's abstract.*)

893D MEETING

The 893d meeting was held in the Cosmos Club Auditorium on Saturday, December 15, 1923. The meeting was called to order by President Hazard with 40 persons in attendance.

The Secretary called the Society's attention to the meetings of the Geological Society of America to be held during the last week in December in the Auditorium of the Department of the Interior.

Program: I. F. HAND: *Investigation of the dust content of the atmosphere.* The paper was illustrated with lantern slides and a dust collector was exhibited.

Daily 8 a.m. determinations of the dust content of the atmosphere have been made by the Weather Bureau since December 7, 1922, at the American University, D. C., as part of an international study carried on by twelve countries belonging to the International Union of Geodesy and Geophysics. The purpose of this investigation is threefold: (1) To correlate the number of particles with visibility, (2) to study the effect of atmospheric dust upon the transmission of the atmosphere for solar radiation, and (3) to study the pollution of the atmosphere in cities. Incidentally, it was hoped that dust of cosmical origin might be identified.

Only particles which may be seen with the aid of a microscope magnifying 1000 diameters are counted. The method thus differs from Aitken's in which water drops are counted under the assumption that each drop contains a dust particle as a nucleus.

Charts were shown giving the relation between the number of particles and visibility; the vertical distribution of dust particles up to 10,000 feet as obtained during numerous airplane flights; and the seasonal variation in the number of particles.

The size of the particles diminishes with altitude, so that on an average the mass of the particles per unit volume at sea-level is 500 times the mass at 10,000 feet.

Miscellaneous observations made during airplane flights were described, including the following: (1) Study of the height of the upper limit of haze, which at times was very sharply defined. (2) Color effects of haze, clouds, sky, water, and ground surfaces with respect to distance, azimuth of sun, heights, etc. (3) Study of the air movement in and around cumulus and alto-cumulus clouds. (4) The observation of a super-cooled alto-cumulus cloud which, although the water content was in liquid form, was below freezing, as ice formed on the wings and struts of the plane and at 14,000 feet the Brocken Specter and Fog Bow were observed. (5) The dissipation of a cumulus cloud by repeatedly passing through it.

A summary of the year's work along this line will be published in an early number of the Monthly Weather Review. (*Author's abstract.*)

Discussion. The paper was discussed by Messrs. LITTLEHALES, BOWIE, KIMBALL, HUMPHREYS, GISH, and BAUER.

H. F. JOHNSTON: *Atmospheric-electric observations during the recent total solar eclipse.* (Illustrated with lantern slides.)

The Department of Terrestrial Magnetism made observations of potential gradient, positive conductivity, and negative conductivity at Point Loma near San Diego, California, September 10, 1923, as well as control observations for the four preceding and following days. Improved bifilar electrometers, which gave dependable determinations of potential, were used. Potential gradient was observed both by eye-readings and by continuous photographic registration. Conductivity was observed simultaneously with two Gerdien conductivity apparatuses. Meteorological conditions were very steady for the day of the eclipse; there was a total range of 2.5° Centigrade in temperature, 9 per cent in relative humidity, and 0.02 inch in barometric pressure. During the 20 minutes following totality, the temperature decreased 0.8° Centigrade, and the relative humidity increased 3 per cent. The sky was completely overcast with fog which extended above 17,000 feet. Observational irregularities due to leak on account of increased humidity or alteration of instrumental constants caused by changes in temperature were smaller than the errors of observation. It was found that the potential gradient for about half an hour immediately following totality was 15 per cent subnormal. The electrical conductivity of the air and the vertical electric air current increased 10 per cent above normal during the 10-minute period following totality. These results are in close agreement with those observed at Lakin, Kansas, in 1918 and at Sobral, Brazil, in 1919. There was a greater increase in the negative conductivity than in the positive conductivity of the order of 15 per cent. (*Author's abstract.*)

Discussion. The paper was discussed by Messrs. MAUCHLY, BAUER, HAZARD, and HUMPHREYS.

J. P. AULT: *Effect of the solar eclipse of 1923 on the earth's magnetic field.* (Illustrated with lantern slides.)

This paper presents a preliminary report on special magnetic observations made by the Department of Terrestrial Magnetism at Point Loma and Mt. Wilson, California, and at Guatemala City, Guatemala, during the solar eclipse of September 10, 1923. At Point Loma, magnetic declination, horizontal intensity, and inclination observations were made while at the other two stations only declination observations were made. Methods and instruments similar to those used during previous eclipses were employed, and the eclipse effects on the Earth's magnetic field were similar to those previously observed. The usual diurnal variation in the Earth's magnetism was interrupted, the change amounting to from 1½ to 3 minutes in declination, 60 gammas in horizontal intensity, and 1½ minutes of inclination. A complete analysis and discussion must await the receipt of data from other observatories located near the belt of totality. (*Author's abstract.*)

Discussion. The paper was discussed by Messrs. HAZARD, BAUER, HUMPHREYS, LITTLEHALES, and GISH.

894TH MEETING

The 894th meeting was held in the Cosmos Club Auditorium on Saturday, January 12, 1924. The meeting was called to order by President Hazard with 62 persons present.

The address of the evening was given by the retiring President W. P WHITE, *Ethics of research.* The address was discussed by Messrs. HEYL, HUMPHREYS, and LITTLEHALES.

895TH MEETING

The 895th meeting was a joint meeting with the Washington Academy of Sciences and the Geological Society of Washington, and was held in the Auditorium of the Interior Building.

The meeting was called to order at 8 p.m. by President A. L. DAY of the Washington Academy of Sciences.

Two addresses were delivered by Dr. T. A. JAGGAR, *The Hawaiian volcanoes* and *The Tokio earthquake*. These addresses were illustrated with lantern slides and motion pictures.

896TH MEETING

The 896th meeting was held in the Cosmos Club Auditorium on Saturday, February 9, 1924. The meeting was called to order at 8:20 p.m. by President Hazard with 56 persons present.

Program: W. BOWIE: *The use of geodetic measurements in detecting horizontal and vertical earth movements.* (Illustrated with lantern slides.)

As a part of the comprehensive plan to study earth movements in regions of seismic activity, outlined by the Committee on Seismology of the Carnegie Institution, of which Dr. A. L. DAY is chairman, the Coast and Geodetic Survey sent a triangulation party to California in 1922 under the direction of C. L. GARNER to reoccupy old triangulation stations, with a view to detecting whether or not there had been any changes in the geographic positions of the several stations since their establishment 35 or more years ago.

After the earthquake of 1906 the Coast and Geodetic Survey sent parties to the field to remeasure the horizontal angles at a number of stations in the vicinity of San Francisco Bay in order to determine whether or not movements had taken place in horizontal directions and the extent of such movements. Reoccupation of the stations was made during the years 1906 and 1907. For that work the line joining stations Mocho and Diablo, somewhat to the eastward of the San Andreas fault, was used as a base, and its length and the positions of its ends were assumed not to have been affected by the 1906 earthquake.

After a careful analysis of the situation, the conclusion was reached by the Committee on Seismology of the Carnegie Institution and the officials of the Coast and Geodetic Survey that it would be better to start the triangulation for the present studies from the stations Round Top and Mt. Lola, peaks on the Sierra Nevadas to the eastward of San Francisco, rather than to depend on stations near the coast.

During the season of 1922, the reoccupation of stations had progressed from the Sierra Nevadas westward to the coast and thence southward just beyond Mt. Hamilton. During the season of 1923 work was resumed where it had been discontinued in 1922 and old stations were reoccupied down to the Santa Barbara channel. Owing to the presence of persistent fogs in Santa Barbara channel, which prevented observations between mainland and island stations, the party was moved to the southern end of the coast triangulation to the eastward of San Diego. Beginning with station Cuyamaca, not far from the Mexican boundary, old triangulation stations were reoccupied along the coast to the Santa Barbara channel. Unfortunately, lack of funds prevented a connection being made with the observations which had been carried to the southward of San Francisco Bay. The connection will be made during the season of 1924.

Preliminary values for the new positions of the triangulation stations, computed from the stations Mt. Lola and Round Top as a base, are now available for comparison with the positions furnished by the original observations. The results of the comparison indicate rather clearly that there has been no movement for 100 miles or more to the westward of Mt. Lola and Round Top. There have been decided changes in position for most of the coast stations. Some of the change in position is necessarily due to the unavoidable accidental errors of triangulation, while at many of the stations the differences in position indicate very clearly that actual earth movements have taken place. It is expected that a publication of the Coast and Geodetic Survey will appear in the not distant future which will show, in tables and graphically, the difference in position of each of the stations involved with an analysis of the portion of the difference which may be due to errors of triangulation and to earth movements.

It is expected that triangulation will be done over all parts of California which show evidence of recent seismic activity. It is also planned to have lines of precise leveling extended over those areas. From time to time in the future, the triangulation and leveling can be reproduced with a view to learning what horizontal and vertical movements have taken place during the interval between the observing periods. (*Author's abstract.*)

Discussion. The paper was discussed by Messrs. LAMBERT, WRIGHT, HUMPHREYS, and RUDE.

S. J. M. ALLEN: *Passage of X-rays through matter, and the atomic structure of commercial materials.* (Illustrated with lantern slides.)

The general radiation from a tungsten Coolidge x-ray tube reflected from a crystal was examined from $\lambda = 0.10$ to $\lambda = 0.51$ A for the total mass absorption, in the metals C, Mg, Al, S, Fe, Ni, Zn, Ag, Sn, W, Pt, Au, Pb, and Bi. The α and β radiation from a Mo tube was also examined for $\lambda = 0.63$ A and 0.71 A. Systematic calculations showed that, if properly chosen values of the scattering were taken, the results could be expressed by formulas of the form $\mu/\rho = C\lambda^n N^p + \sigma/\rho$ over the range of λ and for N up to 0.74. The heavy elements do not agree with the above formula, the "jump" in μ/ρ from L to K absorption decreasing from 5.60 for W to 3.30 for Bi, whilst for Ag it was 7.85. In the atomic form, $C_K = 2.19 \times 10^{21}$, and $p = 4$. Very good agreement was found with the results of Richtmyer and Duane, wherever they paralleled.

The second part of the paper was a report on work done by Walter Soller at the University of Cincinnati. A Bragg x-ray spectrometer was equipped with two specially designed collimators, in place of the ordinary slits, each consisting of a large number of parallel strips of metal arranged in a vertical plane, one being placed between the specimen and the target, the other between the specimen and the ionization chamber. The target was placed so that its plane was perpendicular to the axis of the collimator. The first collimator allows only an essentially parallel beam of large cross-section to irradiate the specimen, the second analyses only those pencils of rays which are almost parallel to a given direction. Experiments showed that the α radiation from a Mo water-cooled tube could be resolved into the α_1 and α_2 components when reflected from a specimen of commercial iron strip. When the strip was heated through 450°C., the observed shift of the peaks corresponded to the shift to be expected from calculation of the thermal expansion of the crystals. When the strip was stretched mechanically, there was observed a decided shift of the peaks. With this spectrometer it is not necessary in any way to prepare the specimen by etching or powdering. (*Author's abstract.*)

Discussion. The paper was discussed by Messrs. FOOTE, MOHLER and RAWDON.

897TH MEETING

The 897th meeting was held in the Cosmos Club Auditorium on Saturday, February 23, 1924. The meeting was called to order by President Hazard with 35 persons in attendance.

Program: C. V. HODGSON: *Structural improvements in modern micrometer theodolites.* (Illustrated with lantern slides).

The paper as presented did not take up the details of micrometer construction or of the general structural arrangements of theodolites, but discussed the progress in the art of designing and making theodolites and compared some of the older types with the modern theodolite in respect to accuracy and convenience.

Slides were shown to illustrate the general appearances of the principal types of precision theodolites used in this country during the past century. Progress in design has been toward compactness, decreased weight and increased convenience, rather than toward revolutionary changes in principle. In workmanship and materials little progress has been made in the past two decades, though a development in the metallurgical processes for making invar, duraluminum and other of the newer alloys may render them more available in the future.

Of the three or four principal structural features of theodolites, the accuracy of the observations depends chiefly upon two—the correctness of the graduation of the circle, and the design and construction of the micrometers. Slides were used to show the magnitude of the errors of graduation of some of the modern theodolite circles, and the sources of the larger errors.

The methods used in testing the graduations were briefly touched upon. Where the error in position of the graduation marks is tested by special apparatus using micrometric measurements, it was estimated that the method of standardization would not determine the errors much closer than 0.3″ on a circle 12 inches in diameter.

The excellence of a theodolite may also be gauged by plotting to scale the differences between the readings of two micrometers, taken at intervals around the circle. A study of the variations of these plotted points from the mean curve drawn through them enables a close estimation to be made of both the errors of graduation and excellence of the micrometers.

There is not in the United States any organization equipped to test adequately the errors of graduation of a circle, and make certification as to its errors. There is need for some agency to assume such a function, for such standardizations would render harmless the extravagant claims of accuracy made by some manufacturers, and would encourage conscientious makers of high-grade instruments to greater precision. (*Author's abstract.*)

Discussion. The paper was discussed by Messrs. PAWLING, W. BOWIE, and HAZARD.

W. R. GREGG: *The relations between free air temperatures and wind directions.* (Illustrated with lantern slides.)

All available data from kite flights made during the period 1915 to 1922 inclusive have been considered. The investigation has been pursued along the following lines: (1) The temperatures at different heights have been classified according to surface wind direction; (2) the temperatures at 3 kilometers have been classified according to wind direction at that level; and (3)

changes in temperatures at 3 kilometers, as observed during series of successive kite flights extending over periods of several hours, have been examined individually in connection with the wind direction or with changes in the wind direction. It is found (a) that in a large majority of cases the relation between temperatures and wind directions is direct and appreciable, south component winds being considerably warmer than north component winds at all levels in the troposphere; (b) that the relation is more pronounced at 1 and 2 kilometers than it is at greater heights or at the surface; and (c) that exceptions to (a) are due either to a temporary reversal in the latitudinal distribution of temperature or to the fact that the wind direction in some instances does not represent the true source of the air, the latter having followed a curved path round a High or Low. (*Author's abstract.*)

Discussion. The paper was discussed by Messrs. HAZARD, AULT, and HUMPHREYS.

898TH MEETING

The 898th meeting was held in the Auditorium of the Cosmos Club on Saturday March 8, 1924. The meeting was called to order at 8:15 p.m. by President Hazard with 35 persons present.

Program: C. LEROY MEISINGER: *Barometric reductions in the plateau region of western United States.* (Illustrated by lantern slides.)

In seeking a suitable level to which to reduce barometric pressures in the Plateau Region of Western United States, it is desirable to choose one that is fairly representative of weather conditions at the surface of the Plateau. This choice has the advantage of greater accuracy than is possible in sea-level reductions since the vertical distances between barometers and the reduction level are much shorter, hence exercise less influence upon the reduced pressure.

The levels 1 and 2 kilometers above sea-level have been used in the eastern United States for the purpose of barometric reduction, and it is found that very reliable results can be obtained in reducing to the same two levels in the Plateau Region. The short air columns permit the use of current surface temperatures as the temperature argument in the reduction equation to produce a smooth homogeneous system of isobars.

A new method of barometric reductions to the levels 3 and 4 kilometers above sea-level has been devised for the eastern United States. This method depends upon the ratios of pressure at the surface, 1, and 2 kilometers above sea-level. Both practical and theoretical considerations show that the linear relation,

$$p_s = p_0 (bp_2/p_1 + a)$$

in which p_s, p_0, p_1 and p_2 are the barometric pressures at some high level, say, three of four kilometers above sea-level, the surface, 1 and 2 kilometers above sea-level, respectively, is useful in computing these pressures. A method for the computation of the linear constants for use at Plateau Stations was presented together with maps for the several levels. These charts afford an opportunity to study the current distribution of barometric pressure to high levels in the atmosphere with as much promptness and ease as is possible with the present sea-level map. (*Author's abstract.*)

Discussion. The paper was discussed by Messrs. PAWLING, TUCKERMAN, HAWKESWORTH, and HUMPHREYS.

E. W. WASHBURN: *A calorimeter for measuring heat effects at high temperatures.* (Illustrated with lantern slides.)

Discussion. The paper was discussed by Messrs. WHITE, L. H. ADAMS, and HAWKESWORTH.

W. P. WHITE presented an informal communication, *Some results obtained during tests of a crude calorimeter.* This communication was discussed by Messrs. Humphreys and Tuckerman.

J. P. AULT, *Recording Secretary.*

THE BIOLOGICAL SOCIETY

659TH MEETING

The 659th meeting of the Biological Society was held in the lecture hall of the Cosmos Club January 5, 1924 at 8 p.m., with Vice-President OBERHOLSER in the chair and 60 persons present.

New members elected: C. S. BRIMLEY, FRANK C. BALDWIN.

The membership of the following committees was announced: *Committee on Communications:* E. A. GOLDMAN, chairman, S. A. ROHWER, H. C. OBERHOLSER, C. E. CHAMBLISS, J. S. GUTSELL, W. R. MAXON; *Committee on Publications:* C. W. RICHMOND, chairman, J. H. RILEY, T. E. SNYDER, F C. LINCOLN, G. S. MILLER, JR.; *Committee on Zoological Nomenclature:* G. S. MILLER, JR., chairman, P. BARTSCH, S. A. ROHWER, E. A. CHAPIN, H. C. OBERHOLSER.

President J. W. GIDLEY was elected a vice president of the Academy of Sciences as representative of the Biological Society of Washington.

Under *Short Notes*, S. F. BLAKE, announced the observation of a Bluegray Gnatcatcher in Washington on January 1, 1924.

W. E. SAFFORD: *Economic plants as indicators of the origin and migrations of primitive races* (illustrated). Ethnologists and anthropologists often disagree as to the importance of the arts and industries of a primitive tribe or the physical characteristics of a people as factors in determining its origin. In contrast with the similarity between arts which may have originated separately and with resemblances which may be more or less fortuitous or imaginary, the botanist has something definite to offer when he contributes his aid in solving questions of origin and relationship of primitive races.

When the earliest explorers of the Pacific Ocean encountered the Polynesians they found that they were cultivating a number of plants for food and for economic purposes, nearly every one of which had been known for centuries in southern Asia and the adjacent islands.' The most important were coconut, breadfruit, bananas, plantains, common yam (*Dioscorea alata*), turmeric, Polynesian arrowroot (*Tacca pinnatifida*), sugar cane, species of screwpine (*Pandanus*), also a number of trees such as *Hibiscus tiliaceus* and the candlenut (*Aleurites moluccana*). The plant from which the Hawaiians derive their *poi* and the Samoans their *palusami* proved to be identical with *Colocasia esculenta*, the qulqás of the Arabs and the arum of ancient Egypt. Nearly all these plants could be traced to the Malay Archipelago and many of them even retained their ancient Malayan names. The dialects of the Polynesians themselves could also be traced back to the same source, demonstrating the absurdity of the theories, so often repeated in recent times, that the Polynesians are of Caucasian origin.

Turning to America there is a striking contrast. Every cultivated plant encountered in the New World by Columbus and his companions and by their successors on the mainland both north and south of the Equator was unknown before the discovery. No foodplant or other cultivated staple from Europe, Asia, or Africa had reached this continent in Precolumbian times. Even the various species of cotton used for textile purposes in the Antilles and on

the mainland were so distinct that they would not cross with Old World species. All the plants cultivated by the various tribes had been developed from wild American plants,—maize from a wild grass, beans from vines in thickets, sweet potatoes from wild morning-glories, squashes and pumpkins from wild gourds, white potatoes from wild Solanums growing in the Andine region of South America, and tobacco from wild species of *Nicotiana*.

Very little is known regarding the connection between the tribes of North and South America. By linguistic methods, however, it is possible to trace connections between the Aztecs of Mexico and various tribes in North America as far as the Shoshones to the northward, and a relationship to other tribes of Salvador and Costa Rica to the southward. Making use of the common foodplants, tobacco, peanuts, cotton, *Bixa orellana* and *Genipa americana*, used for painting the body, it is possible to trace the origin of the Caribs and Arawaks encountered by Columbus in the West Indies to the very heart of South America. Similarly the black Caribs of Guatemala, descended from negro slaves and their Carib masters of the West Indies, can be traced by means of their manioc, or cassava, and other food plants to the Caribs of the Antilles; and this relationship is corroborated by the language which they still speak, that of the women and the men differing from each other, as it did in those islands.

There is a difference between the intrusion of a plant with its complex method of cultivation and preparation, and the introduction of a plant by means of seeds or roots sent from one country to another. An example of this is the manioc just referred to. When the black Caribs were transported from their island home to the east coast of Central America, they took with them their method of preparing the cassava, expressing the poisonous juice by means of a long hollow woven snake-like cylinder. When manioc roots were sent to Africa, not carried there by immigrants, no knowledge of methods of manufacture of cassava accompanied them; and the natives at present prepare it by allowing the root to ferment and thus destroy its poisonous qualities. They do not have the peculiar snake-like tubes, which were first invented by tribes in Brazil, carried into the Antilles and thence to the main-land of Central America. This is a striking example of the difference between the introduction of a plant and of the bringing into a new country of a complex by migrant tribes or groups of people. Maize found its way to the Island of Guam together with the *metatl* and *mano*, and was prepared in the form of tortillas; thus establishes the fact that Mexicans migrated from Mexico to Guam, as we know to be the fact, when the Spaniards transported Mexican troops to reduce the native Chamorros. The introduction of corn, beans, and squashes into North America from the south was a very different matter. Evidently the seeds were carried there by people not familiar with Mexican or Central American methods of preparing these articles for food. Thus it may be seen that cultivated plants are important as indices of the origin and migrations of primitive peoples. (*Author's abstract.*)

VERNON BAILEY: *Some habits of the grasshopper mouse, an insect-eating rodent* (illustrated). The speaker exhibited a specimen of *Onychomys leucogaster melanophrys*, a grasshopper mouse from northern Arizona, and described its habits, both in the wild state and in captivity. The animal is very active, almost weasel-like in some of its actions.

660TH MEETING

The 660th meeting was held at the Cosmos Club January 19, 1924 at 8 p.m., with President GIDLEY in the chair and 41 persons present.

Short Notes. B. A. BEAN announced that the Bibliography of Fishes which has been in course of publication by Prof. BASHFORD DEAN for many years has now been completed.

PAUL BARTSCH reported that he has recently observed gray squirrels scratching and rolling in decayed wood from a porch which is being repaired, in much the same way that cats do in catnip. E. A. GOLDMAN suggested that this might be to keep their fur in condition, but Dr. BARTSCH doubted that this was the case.

PAUL BARTSCH: *Additional facts concerning the Cerion breeding experiments* (illustrated). The Cerions form a family of terrestrial mollusks distributed from the Florida Keys and the Bahamas south over the Greater Antilles from Cuba east to the Virgin Isles excepting Jamaica. A colony is also found on the island of Curaçao, and one species has been reported from the mainland of South America at Berbice, British Guiana.

The fact that Cerions always occur in great abundance wherever they are found and embrace a large number of species occupying usually very circumscribed areas renders these forms particularly interesting subjects for biologic inquiry.

Efforts so far have been directed along two lines: one, to determine the effects of environment, the other to determine the effects of hybridization. In the first series of experiments a large number of individuals of two species of Bahaman Cerions was planted on alternate keys between Miami and the Tortugas, a distance of over 250 miles. These keys present a great range of variation in temperature, moisture, food, and other environmental factors. The various generations resulting from these colonies, which consisted of 500 individuals each, have been kept apart and carefully studied. All the measurable characters presented by the F_1 and F_2 generations of these two species have failed to show any response to the changed environment. At the Tortugas, additional species have been introduced from Porto Rico and Curaçao, the offspring of which likewise show no change from the parent stock in the Florida grown generations.

In the second experiment the Floridan *Cerion incanum* was crossed with *Cerion viaregis* from Andros Island, Bahamas. The offspring show an enormous diversity of modification in which one can recognize many of the types of modifications existing among the hundreds of species which occupy the Bahama Islands today. It is not far amiss to say that all the main factors of modification are represented here except that of spiral striations. It will be interesting to note what results fixation through isolation and inbreeding will produce.

It seems likely that the large number of species of Cerion found in the Bahamas today may be due to a cross probably made possible by the abstraction of water from the seas during the glacial period, resulting in the wide spreading of an exceedingly variable hybrid which later, through the return of the water to the seas by the melting of the ice cap, resulted in the production of an endless number of isolated colonies where, by inbreeding, fixation has taken place, giving us the hundreds of species which we now find in the region. (*Author's abstract.*)

C. D. MARSH: *Relation of poisonous plants to milk-sickness in man and animals.* The first publication in regard to the disease which came to be known as "milk-sickness" was in 1810, although the disease had probably been known for many years before that time. The disease has been at times very prevalent in the states from the Carolinas west to Missouri. While the disease was first known amongst men, later it was found to affect practically

all domestic animals. It came to be known as "milk-sickness" because it was thought that it was conveyed from cattle to human beings by means of milk and butter. It was also known as "trembles" because of one of the prominent symptoms amongst cattle. It was a mysterious disease and the cause was not definitely known until very recent times. Some thought it to be of mineral origin. Some thought it due to an emanation from the soil, and many thought it was caused by some plant which was consumed by grazing animals. In the first decade of this century, it was quite generally thought to be of bacterial origin. Experiments made by the U. S. Department of Agriculture and confirmed by many other investigators have shown quite conclusively that the disease in animals is caused by eating white snakeroot (*Eupatorium urticaefolium*).

A similar disease, sometimes also called milk-sickness, perhaps more commonly alkali disease, has been common in the Pecos Valley in New Mexico. This also was thought to be caused by bacteria, but now it has been shown by the work of the Department of Agriculture that this disease, which produces symptoms practically identical with those of the Eastern milk-sickness, is caused by a plant commonly known as rayless golden rod or Jimmy weed (*Isocoma wrightii*). (*Author's abstract.*)

661ST MEETING

The 661st meeting was held in the Lecture Hall of the Cosmos Club February 2, 1924, at 8 p.m., with President GIDLEY in the chair and 90 persons present. WILBER BROTHERTON, JR. was elected to membership.

Under *Short Notes*, VERNON BAILEY described the behavior of chipmunks from northern Michigan, kept under approximately natural conditions in his backyard. They have stored a considerable amount of food but have not hibernated. It is not known whether the chipmunks in the north truly hibernate or whether they keep awake during the greater part of the winter.

Dr. C. W. STILES stated that the proposed suspension of the rules in the case of the typification of *Musca* has not yet been settled. Voting so far favors the retention of *M. domestica* as type. It is hoped that entomologists will refrain from other usage until the matter is finally settled.

A. WETMORE: *Visit of a naturalist to Wake Island* (illustrated).—Wake Island, discovered in 1796, is located in the western Pacific, 19° north of the Equator, and approximately 2,000 miles west of Honolulu. It lies distant 1,330 miles from Guam, with Taongi Atoll, an outlier of the Marshall group, and Marcus Island as the nearest land. The island was visited for a few hours by naturalists on the Wilkes Expedition on December 20, 1841, and in 1892 a Japanese vessel secured specimens of a land rail that later came into possession of the Tring Museum, and were described by Rothschild in 1903 as *Hypotaenidia wakensis*. The U. S. S. "Beaver" secured a few land crabs there in June, 1922, which were given to the Bishop Museum. These, so far as known, constitute the only occasions on which natural history collections were made on the island until the summer of 1923, when an expedition organized by the Biological Survey, U. S. Department of Agriculture, and the Bishop Museum of Honolulu, in cooperation with the Navy Department, came to Wake Island on the U. S. S. "Tanager" and remained there for a period of nine days. The scientific party, under direction of the speaker, made complete collections of the land flora and fauna, and secured as complete a representation of the marine life of the reefs as practicable in the time available. At the same time, the three islands forming the atoll were accurately mapped, and their proper location determined by numerous observations. The speaker gave a résumé

of the more striking features in various branches of natural history, with narration of various episodes in connection with life in camp, and the work of the party. Complete accounts of the collections made will be published in the bulletin series of the Bishop Museum in Honolulu. (*Author's abstract.*)

The paper was discussed by E. A. GOLDMAN and R. W. SHUFELDT. Dr. Shufeldt described a meeting with Capt. WILKES in 1863, and a later one in Washington just before Wilkes' death.

MAURICE K. BRADY: *Salamanders of the District of Columbia.* The speaker described the salamanders of the District and illustrated them with lantern slides and a few living specimens. One species new to the District, *Pseudotriton montanus montanus,* has been found since the publication of Hay's list. No specimens have hitherto been known from the area between North Carolina and the type locality near Carlisle, Pa. The suggestion was made that several species included on hypothetical grounds by Hay should be eliminated.

662D MEETING

The 662d meeting was held at the Cosmos Club on February 16, 1924, at 8 p.m., with Vice-President OBERHOLSER in the chair and 67 persons present.

Under *Short Notes.* Dr. PAUL JOHNSON read an extract from a medical journal, indicating a considerable degree of correlation between certain physical measurements and the susceptibility of humans to certain diseases.

M. K. BRADY stated that he and E. J. COURT had found half a dozen adult specimens with larvae or *Pseudotriton montanus montanus* at Mt. Vernon, Virginia, since his recent report of the species from near Little Hunting Creek. The species was in association with *P. ruber.*

L. O. HOWARD: *Importing foreign parasites of introduced injurious insects.* (illustrated). The speaker described and illustrated by lantern slides a considerable number of our important injurious insects, and gave an account of the attempts made to combat their ravages by the introduction of parasites. The usual method by which these were discovered was the observation in their Old World home of the insects themselves and of the parasites which naturally preyed upon them there. In this way it has been possible to control or almost exterminate a number of important introduced pests.

VERNON BAILEY: *Hoarding habits of mammals in relation to disposition and social instincts* (illustrated). The speaker described the life and feeding habits of a number of American mammals, with particular reference to their habit of storing food. The varied dispositions of the species, particularly of the rodent tribe, were described and the strong resemblance to many human qualities was mentioned. The paper was illustrated by colored slides.

663D MEETING

The 663d meeting was held at the Cosmos Club March 1, 1924 at 8.10 p.m., with Vice-President OBERHOLSER in the chair and 111 persons present.

Under *Short Notes,* A. S. HITCHCOCK spoke of progress in the construction of the laboratory to be maintained in the Canal Zone by the Institute for Research in Tropical America.

H. M. ALBRIGHT, Superintendent, Yellowstone National Park: *Progress in wild life protection in Yellowstone National Park* (illustrated). The speaker showed a large number of beautifully colored lantern slides illustrating the scenery and wild life of the Park. He reported that the elk and antelope have wintered very well, and that both are rapidly increasing in numbers. In conclusion, he showed a remarkable moving picture of the Rocky Mountain goat in its native haunts.

O. F. COOK: *The domestication of plants in Peru* (illustrated). The origin of civilization may be traced through agriculture, by locating the centers of plant domestication. In the American continents the chief domestication center undoubtedly was located in the Peruvian region, as shown by the large series of plants cultivated by the ancient Peruvians, greatly exceeding the domesticated series of any other region. The Peruvian domestication covered the whole range of agricultural conditions, from the tropical valleys of the eastern Andes to the highest limits of cultivation, above 14,000 feet. Most of the chief economic groups, root-crops, seed-crops, garden vegetables, fruits, ornamentals, and medicinal plants are represented by several species growing at different altitudes.

Though many of the low-elevation species were also cultivated widely in tropical America, many of the high-altitude species are still restricted to the Peruvian region. The presence of closely related wild plants affords further evidence of the place of domestication of many of the species, and the very specialized development of agriculture in Peru is another indication of great antiquity. From the nature of the stonework in the terraces, some of them must go back to a remote prehistoric age. The construction of terraces and irrigation works, including the artificial placement of the soil over many square miles of the terraced valleys, required an enormous application of labor and a notable development of engineering and organization ability, that probably required a very long period of time. (*Author's abstract.*)

S. F. BLAKE, *Recording Secretary.*

SCIENTIFIC NOTES AND NEWS

The Petrologists Club met at the home of L. M. PRINDLE, April 18. The following papers were presented:

F. L. HESS, *Rutile deposits of Virginia.*

D. F. HEWETT, *Mass changes in replacement.*

E. T. WHERRY, *Volcanic rocks of South Mountain, Pa.*

The paper by Mr. HESS was preparatory to the proposed excursion of the club to the titaniferous rock areas of Nelson County, Virginia on May 3.

The following lectures were announced for the Bureau of Standards Physics Club during March and April:

March 10. *Materials and structural testing,* L. B. TUCKERMAN.

March 17. *The mechanism of electro-deposition,* W. BLUM and H. S. RAWDON.

Three lectures on *Some high lights of visual psycho-physics,* by I. G. PRIEST as follows:

March 24. *The classification and nomenclature of colors.*

March 31. *General review of the leading principles of visual psycho-physics.*

April 7. *Equivalent stimuli and relations deduced from the laws of mixture of stimuli.*

The Washington, D. C., Chapter of the Wild Flower Preservation Society of America is planning to prepare a supplement to the flora of Washington and vicinity which was published in 1919, to include the species which have been found in this region since that time. Everyone who has reports of new finds to make is urged to send them in for inclusion in this supplement. Specimens should be deposited in the National Herbarium at the same time, if practicable. President, E. T. WHERRY, Bureau of Chemistry; Secretary, P. L. RICKER, Bureau of Plant Industry.

Dr. F. L. RANSOME has tendered his resignation as geologist in the U. S. Geological Survey, to become effective May 16. He will continue his present work as head of the department of geology and mineralogy of the University of Arizona.

B. S. BUTLER, who has been engaged for several years past in the study of the copper deposits of the Lake Superior region, resumed work for the U. S. Geological Survey on April 16. W. S. BURBANK will be his assistant in field work in the Lake Superior region.

Dr. MANUAL GAMIO Director of the Department of Anthropology of Mexico lectured on *Archeological conditions of today and the future* at the Carnegie Institution of Washington, April 17.

Dr. THOMAS CORWIN MENDENHALL, physicist and educator, superintendent of the U. S. Coast and Geodetic Survey from 1889 to 1894, died at his home at Ravenna, Ohio, on March 23, 1924, at the age of 82.

The death of Prof. Fusakichi Omori, who was recognized as a leading authority in seismology, took place on November 8, 1923, in Tokyo. Born on October 30th, 1868, at Fukui, he entered the College of Science of the Imperial University of Tokyo, in his nineteenth year and studied physics until 1890, when he graduated from the college course. He then studied seismology and meteorology as a post graduate. In 1891 he became an assistant and in 1893 a lecturer on seismology. In 1895 he was sent to Italy and Germany for further researches, where he stayed two years. On the death of his teacher, Prof. S. Sekiya, Prof. Omori succeeded him in 1897 in the chair of seismology, which he occupied to the day of his death. In 1892, when the Earthquake Investigation Committee was organized by the government, he became a member of that Committee and served as its secretary after 1897; in 1917 he was elected as it's president. He was also a member of the Imperial Academy of Japan, Vice President of the Tokyo Geographical Society, Foreign Member of the Reale Academia dei Lincei, Roma, Foreign Member of the Washington Academy of Sciences, etc., etc. He was sent abroad often as a delegate to the International Conferences of Seismology and Geodesy. Recently, he visited Australia to attend the second Pan-Pacific Science Congress. His health declined steadily on his way home and he eventually passed away in the university hospital near his half damaged institute, where he spent the best years of his life.

His entire life was devoted to the investigation of seismology and vulcanology, the latter from the standpoint of physics, especially. His papers number more than one hundred each in English and Japanese, and are mostly contributed to the publications of the Imperial Earthquake Investigation Committee. On the basis of his early researches, he offered an explanation of the relation between the time and frequency of after-shocks of an earthquake. Later, with others, he described the relation between the duration of the preliminary tremors and the epicentral distances. He designed the well-known Omori's Horizontal pendulum tromometer, and discussed its theory and construction. He discussed also the similarity of the seismograms due to earthquakes of near origins. Studies of earth pulsation and earthquake zones constitute parts of his important works. He described and discussed many

destructive earthquakes at home and abroad and visited personally the fields of catastrophe in Assam, Kangra, San Francisco and Messina. All reports of these investigations were published in the Journal of the Committee. The paper on the variation of the mean sea level at the different tide guage stations in Japan and that on "Tsunami" or seismic tidal waves, are also the result of very interesting researches.

Beside the problems of pure physics, he turned his attention to the subject of applied science and measured the vibration of various kinds of buildings, bridges and piers, trains and ships with his special instrument. He also designed a deflectometer for bridges. He made several experiments on the overturning, sliding and fracturing of wooden and brick columns of various heights. Some observations on iron aqueducts resistent against earthquake shocks were made by him. These researches are said to have served to prevent or at least to diminish earthquake disaster on several occasions.

In the first and second decades of this century when many volcanoes of Japan renewed their activity, he took advantage of the opportunities to investigate the physical phenomena of these eruptions. Usu in Hokkaido, Asama in Central Japan and Sakura-jima in Kyushu were the most important subjects of his work. He also compiled many historical records of great catastrophies in Japan from ancient times to the present and published two large volumes on "*Japanese great earthquakes*" and "*Volcanic eruptions of Japan.*"

His death was indeed a great loss to Japan, especially in the period of the recent great disaster, when much aid of his knowledge and experience was demanded. His death is deeply lamented by all who knew him on account of his scientific attainments and his personal worth. It must be considered as the highest honour to a man of science in the land of his birth, that he was decorated with the highest order of the Sacred Treasure from the Imperial court, at the last moment of his illness. (Communicated by T. W. Vaughan.)

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